especially in bringing down the arm, when previously raised, as in striking with the hammer, pickaxe, &c., where velocity is chiefly required, the weight of the instrument held in the hand sufficiently supplying the diminution of force. On the contrary, the lever by which the upper portion of the same muscle is enabled to act being, from the more distant insertion of its tendon, of greater length, is calculated to procure force at the expense of velocity, and is therefore peculiarly fitted for the performance of those actions by which the arm is elevated and weights raised; these being precisely the actions in which such muscles are employed. Adverting, also, to the respective obliquities in the direction of their action, the author traces the same express correspondence between the mechanism employed and the purpose contemplated. He pursues the same line of argument and obtains the same results in extending the inquiry to the structure and uses of those muscles, such as the coraco-brachialis, and the anterior fibres of the deltoid, which cooperate with the upper division of the pectoralis major; and the teres major and latissimus dorsi, which combine their actions with that of the lower division of the pectoral muscle.

This diversified adaptation of parts, he observes, forms the chief characteristic of the mechanism of Nature. Operating with unlimited means, she yet works with scrupulous economy; in all her structures no power is redundant, nor a single advantage lost: so that, however completely an arrangement may be subservient to one primary purpose, we find, on renewed examination, an equally accurate adjustment to various secondary and no less important ends.

The author then proceeds to inquire into the methods employed for determining the absolute and relative strength of muscles; and proposes, for that purpose, the application of the constant and equable stream of galvanism afforded by the new battery invented by Mr. Daniell.

10. "An Experimental Inquiry into what takes place during the Vinous, the Acetous, and different Putrefactive Fermentations of dissolved Vegetable Matter; and an Examination of some of the Products." By Robert Rigg, Esq. Communicated by P. M. Roget, M.D., Sec. R.S.

The author describes with great minuteness a long train of experiments on the subjects announced in the title of the paper. His first object of inquiry is into the nature of the changes which take place during the vinous fermentation; and the conclusion to which he arrives is, that in the formation of the products resulting from this process sugar is not the only vegetable principle which is decomposed, but that the changes consist in the combination of two equivalents of carbon, derived from the sugar of the malt, or other vegetable matter, (= 12·24) with two equivalents of hydrogen from water (= 2·) forming 14·24 parts of olefiant gas: and in the combination of one equivalent of the carbon from the sugar, &c. (= 6·12) with two equivalents of oxygen from water, (= 16·) forming 22·12 parts of carbonic acid. He thinks that, on this change taking place, the olefiant

gas is held in solution by the water by an affinity which can be overcome, and that the foreign matter which, with the carbon, formed the sugar, or other vegetable substance, is then at liberty to form new combinations. He finds that the products resulting from the decomposition exceed the weight of the sugar, or other vegetable matter, by about 10 per cent. of the former, and from 11 to 12 per cent. of the latter, as calculated according to the prevailing theory that sugar, or vegetable matter, is the only substance decomposed during the process of vinous fermentation.

From his analysis of sugar he obtains certain proportions of water and of carbonic acid which are different from those given by preceding chemists, the carbonic acid being 45 to 45·5 per cent. His analysis of alcohol gives him 59·7 to 60 per cent. of olefiant gas, the remainder being water.

His experiments on the acetous and putrefactive fermentations are numerous and elaborate, and the results, which are nearly the same as those of former analyses, are given in a tabular form. He finds that in the acetous fermentation 57 parts by weight of olefiant gas, 5 of sugar, or other vegetable matter, and 64 of oxygen from the atmosphere, combine to form 100 parts of acetic acid, and about 24 of water; leaving an insoluble substance at liberty to form other combinations: and thus includes in his account of this process the decomposition of vegetable matter, which is overlooked in the generally received theory.

During the putrefactive fermentation of vinous fermented liquors, when exposed to the atmosphere, the author considers that one equivalent of carbon from the olefiant gas (= 6·12) unites with two of oxygen from the atmosphere (= 16·) to form 22·12 parts of carbonic acid: while one equivalent of hydrogen from the olefiant gas (= 1·) combines with one of atmospheric oxygen (= 8·) to form 9 parts of water; a portion of sugar, or other vegetable matter, being also decomposed; and an insoluble substance remaining, which, on exposure to the air, undergoes further decomposition, and forms products highly deleterious. The author is not aware that this latter decomposition has been hitherto noticed.

During the putrefactive fermentation of acetic acid exposed to the atmosphere, he regards one equivalent of carbon from acetic acid (= 6·12) as combining with two of atmospheric oxygen (= 16·) to form 22·12 parts of carbonic acid: the oxygen and hydrogen, with which the carbon had formed the acetic acid, remain in the state of water, as they are found by analysis in this substance: a portion of vegetable matter is also decomposed; and an insoluble substance left behind. Other substances are also formed during some of the changes resulting from exposure to the air.

During the direct putrefactive fermentation of solutions of sugar, or other vegetable matters, he finds, that one equivalent of its carbon (= 6·12) unites with two of atmospheric oxygen (= 16·) to form 22·12 parts of carbonic acid; leaving the water and an insoluble substance to undergo changes as before mentioned. The olefiant gas, formed during the vinous fermentation, whether the liquor be in the

state of vinous fluid, weak spirit, strong spirit, or even of alcohol, or ether, is subject to precisely the same decomposition, under favourable circumstances for such changes, without any action upon, or relation to the water which may happen to be combined with it in each kind of liquor. This olefiant gas cannot, either by distillation or other means, be separated along with any of the water with which it is at first combined, and again united with the same materials, without forming a compound different from the original one: and in proportion as water is, by any means, removed, we obtain it in a somewhat different state; and this happens without reference to a separate and distinct substance which we may call alcohol, or ether. Thus neither of these two ill-defined substances ought to be regarded as a separate and distinct principle; but the whole series of bodies, from the weakest fermented liquor, separated from its vegetable matter, to the most highly rectified ether, consist only of different combinations of olefiant gas, the first product of vinous fermentation, and water.

11. "On the Chemical Changes occurring in Seeds during Germination." By the same.

The author infers, from his researches on the subject of his second paper, that during the process of germination there is a production of alcohol, and that oxygen unites with olefiant gas, under the influence of the radicle and plumula. He accounts for the increase of temperature during germination by an alleged difference in the specific heats of the principles before and after that process has commenced; but the methods he employed for establishing the reality of this difference are not detailed.

The following are the principal conclusions to which the author arrives:

1. Seeds may, by careful desiccation, be deprived of much water without injuring their vegetating organs.

2. Their capacity for absorbing water varies with the temperature at which they are kept.

3. The increase taking place in their volume by the absorption of water is influenced by temperature.

4. On steeping seeds in water at one temperature the vinous fermentation takes place, but at another this process does not occur.

5. A decomposition takes place in seeds previously to their germination, and the products are carbonic acid and olefiant gas.

6. The abstraction of carbon from seeds by the oxygen of the atmosphere is not, as is generally supposed, the specific action which gives rise to germination; but it rather conduces to putrefaction.

7. The germination of seeds appears to be an action taking place between the olefiant gas, which has been previously formed by a vinous fermentation, and the oxygen of the atmosphere; and is effected by the peculiar operation of the plumula and the rootlets.

8. This decomposition and combination of the different elements go on, in well-regulated processes, as long as there is any farinaceous matter to be decomposed: the food of the plant being at this time always the oxygen of the atmosphere, and the newly-formed olefiant